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NEW YORK, SATURDAY, AUGUST 13, 1921

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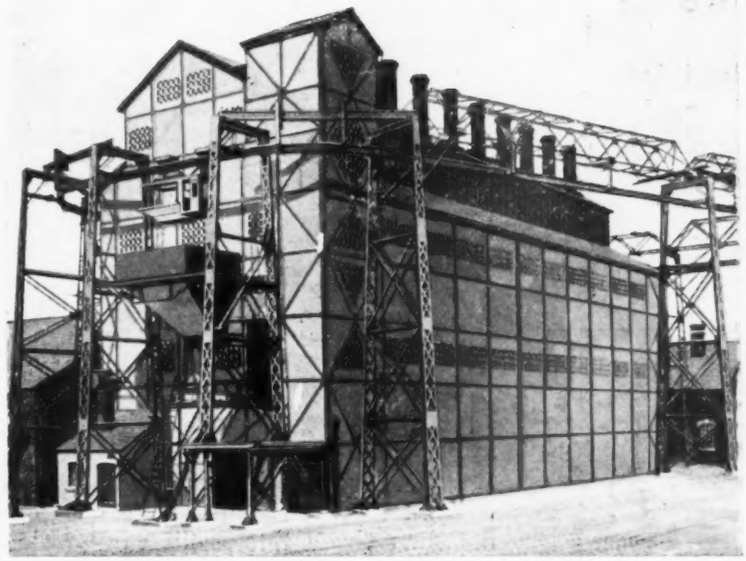
GLOVER-WEST

VERTICAL RETORTS



Carbonize any coals without change in retort house routine

Other Important Features of the Glover-West Plants. Call for Your Investigation

WEST GAS IMPROVEMENT CO.
of America, Inc.
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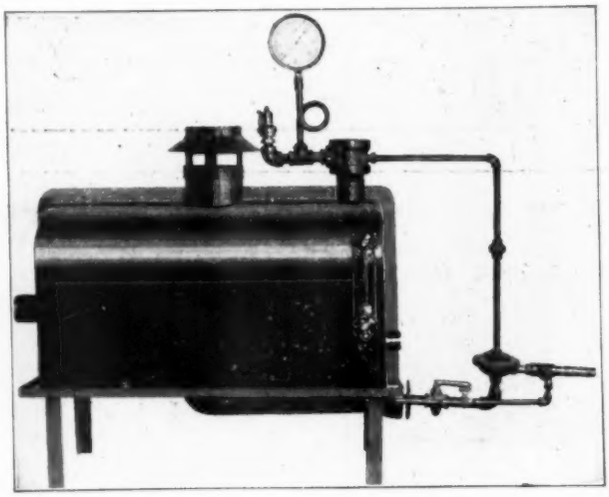
ANNOUNCING THE NEW

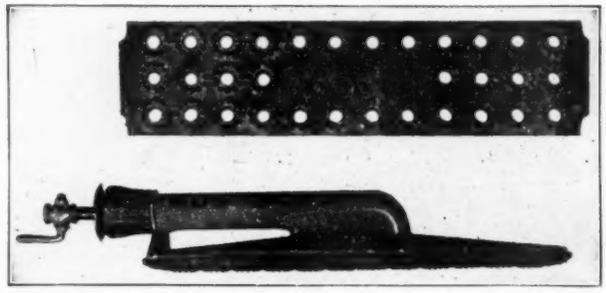
Type "K" Vesuvius Gas-Fired Heating Unit



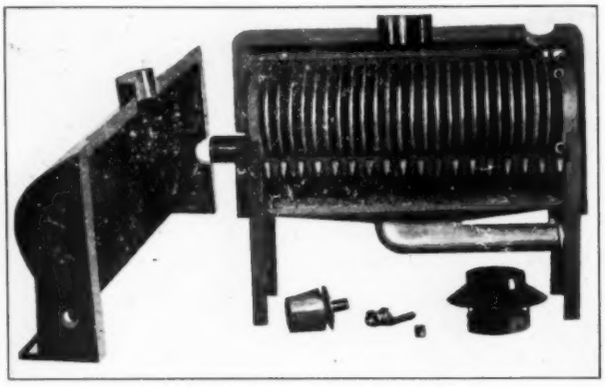
Type "K" Unit Assembled Ready to Connect

to be used on steam or hot water radiation. The VESUVIUS Heat Unit solves the boiler space problem because it occupies a space of only 2 ft. 8 inches long by 1 ft. 6 inches wide by 3 ft. 1 inch high, and each unit will accommodate 250 square feet of direct cast iron steam radiation or 400 square feet of direct cast iron.

The burner is rectangular and is 6½ inches wide, 26 inches long, 5 inches high. It is cast in one piece with 32 clusters of 12 burner ports to each cluster. THIS CONSTRUCTION INSURES CORRECT COMBUSTION OF THE GAS.



Type "K" Burner



Type "K" Unit Dissembled

The VESUVIUS Heating Unit consists of a cast iron cylindrical boiler, around the sides of which are cast a series of cored fins extending from bottom to top, the flue gases passing between these fins from combustion chamber to outlet at top, thus utilizing all the heat units. The jacket is so constructed that the two parts are readily removed without disturbing the asbestos covering.

These units are also adapted to heating water in storage tanks, each unit heating up to 350 gallons.

The sales possibilities of the VESUVIUS are unlimited. Send now for our illustrated catalog and sales plans.

THE VESUVIUS ENGINEERING CO., Inc.

505 Fifth Avenue New York, N. Y.

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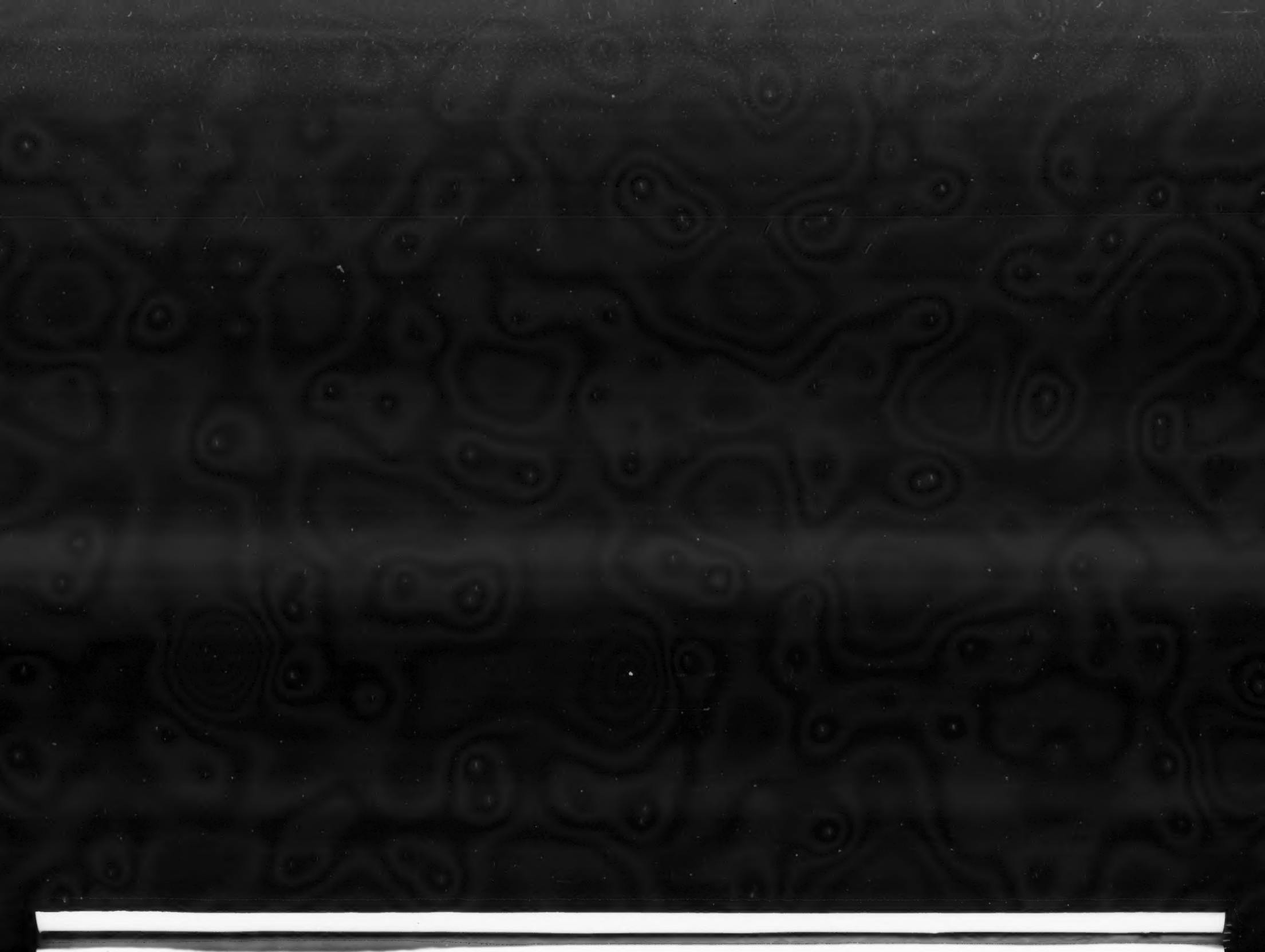


American Gas Journal
Formerly American Gas Light Journal

Vol. CXV, No. 7 NEW YORK, AUGUST 13, 1921 Whole No. 3310

Boiler Rooms

Suggestions for Proper Maintenance and Operation

The following suggestions for maintenance and operation of boiler rooms are supplemental to local laws and ordinances, and the requirements of insurance companies. Attention is directed to the Boiler Code of the American Society of Mechanical Engineers and compliance with that code is recommended.

In carelessly kept boiler rooms the stumbling hazard is present in an aggravated form. Loose coal is a prolific cause of accidents. If firing tools are carelessly placed one is almost certain to find in the same room, steam hose carelessly thrown down, wheelbarrows left projecting from dark corners, skids or planks behind the doors, and scores of other hazards inviting accidents.

Boiler rooms present many hazards and unless the employee is carefully instructed and watched there are apt to be many accidents. This article points out many precautions that should be taken in order to safeguard the plant.—Editor.

Space from the furnace door to wall of room, other boiler setting, coal pile, or other obstruction, should be sufficient to permit withdrawal of the longest tool without hazard or inconvenience.

If there is sufficient space beside the boiler, racks for tools should be provided on the boiler setting. Other suitable places may be the front of the setting, the wall of the room in front of the boiler, or the back of the boiler setting. Tool racks must be substantially built. They must prevent falling of tools and must not form obstructions. Backs recessed in walls are usually satisfactory.

The practice of allowing tools to lie on floor is inexcusable.

Exits

Two or more ways of exit should be provided from boiler rooms. The exits should be plainly marked and illuminated and the exit doors should swing out from the room.

Boiler rooms are often slighted as regards both lighting and ventilating. Coal seems to suggest dirt, darkness, and disorder to the unthinking, but the visitor to this department is often struck by the painstaking efforts of the grimy firemen in their attempts to secure order and safety.

Elevated Runways

Elevated runways should be strongly constructed and adequately railed and protected. Entrance should be by metal or concrete stairways (see National Safety Council's "Safe Practices — Stairs and Stairways"). Flooring of runways should be of grating type rather than of solid construction—the likelihood of accumulating coal dust on closed construction influencing the choice.

Several levels of runways may be found in the properly equipped and up-to-date boiler room, whereas in the older construction ladders are depended upon to reach the several points necessary in the course of the day's work. In addition to stairs and runways, chain or indirect control of several of the vital valves and safety appliances will be found most advisable.

Brick flooring is sometimes recommended in handbooks on this subject. While it is a non-conductor of heat, it lacks smoothness and consequently does not lend itself to efficient operation.

Types of floors may be different around boiler settings and under coal piles. Floors immediately around boilers should be of metal plate with abrasive surface or of concrete. Under the coal pile, concrete will afford suitable footing and will not interfere with use of shovel.

Metal plate or grating should be used where ash conveyor is let into floor. Non-slip surface should be used.

If inclines are used, construction should conform to that outlined under "Inclines" in "Safe Practices—Stairs and Stairways."

If coal is dumped from railroad cars into a hopper a metal grating should be used near the top of the hopper to prevent workmen falling into it. Grating should be of such character as to permit efficient handling of coal and at the same time to afford maximum protection for workmen.

A workman entering a bin should wear a safety belt and life line. Upper end of life line should be securely attached to stationary object. A companion workman should keep line adjusted short enough to prevent man in bin from being drawn under material.

We desire to call attention to the method of storing fuel in many boiler rooms. Coal is often cribbed to a height of several feet and, between cribbings, retaining planks are placed for the retention of excess coal, and then more and still more coal is piled on top of the last. Valuable space is sacrificed, the stumbling hazard is multiplied, and frequently no beneficial result is obtained.

In ordinary practice only a sufficient amount of coal for the period between replenishments—with a moderate reserve—should be allowed in the room.

Water Supply

If a reservoir is used as a water supply it should be fenced to a height of at least seven feet. Eighteen inches or more should be allowed between fence and curbing for use in cleaning or emergency work. Gates should be securely locked and admittance refused to any except specified workmen. If side walls of reservoir are perpendicular or slope is at a sharp angle a safety grab rail at about water level will, at times, prove invaluable in preventing accidents. The usual rail guards are not sufficient protection for reservoirs

A fixed ladder or stairway should be installed—this to reach low-water mark—as a means of escape in case of accident.

From Water Supply to Boilers

In the economizer the temperature of the water is frequently raised to nearly that of the boiler. As the economizer is under the same pressure as the boiler, precautions should be taken to maintain and operate the economizer with the greatest care. The water should enter the boiler after passing through a check valve. A safety valve should be provided for each economizer.

The boiler itself should conform to the A. S. M. E. code.

Many engineers recommend that the tops of boiler settings be made flat so that the repairmen are provided with a rapid means of escape from tops of the boilers in an emergency, and with a safe route to travel in their work. This is done by filling around the drums or shells with an insulating compound, with four or five inches of concrete on top.

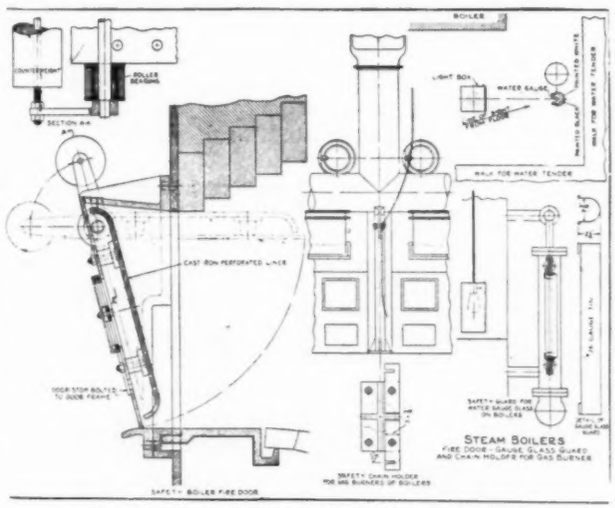
If flat-top settings are impracticable a continuous walkway (with standard railings and toeboards) should be provided over each bank of boilers. The walkways should be arranged so that steam valves and safety valves are accessible from them.

Safety valves should not discharge across the tops of boilers. Direct the discharges upward and have them above the heads of men who might be working around them When discharge pipes are carried through roofs, the outlets should be at least seven feet above the roof levels.

Where discharges are not self-draining, open drains of non-corrosive material should be placed at the lowest possible points. These will insure against collection of water, and discharge of much hot water when valves open. Drains should be piped away from tops of boilers.

Leaving the boiler and allied appliances, the steam passes through a triple-acting valve and an ordinary stop valve into the steam main and is on its way to the prime mover.

Safe and convenient access to each valve should be provided (preferably two) by means of stairs or walkways equipped with railings. Sufficient headroom (at least six feet) and adequate illumination should be provided.



FIRE DOOR, GAUGE GLASS GUARD, AND CHAIN HOLDER FOR GAS BURNER

Steam connections, valves, and main are all specifically set forth in the handbooks on boiler practice and will not be duplicated here.

A full list of safety equipment will be found in the A. S. M. E. code

Operating Rules for Boilers—Starting Fires in a Cold Boiler Setting

If a boiler in a battery that is in service has been out of use for a time sufficient to permit all parts of the setting to become cold, or if it is a new boiler, the following method of starting it up is advised:

The stop valve between the "goose neck" and the header should be tight; the drain pipes in the "goose neck" and the drain valve underneath the non-return valve should be open; and the connection to the steam gauge should be open and in good condition.

Open the feed valve and fill the boiler gradually until the water level stands, between the first and second gauges of the boiler.

Start a very light wood fire in the furnace, and have the damper in the stack practically closed. The escape of smoke from the setting will indicate any air leaks, unclosed doors or other defects which are undesirable when a boiler is in service. If any such leaks are observed they should be corrected before going further; in case of a new boiler, or a boiler with new brick work in the furnace, this preliminary

heating should be continued for a day or two if possible before going further.

Continue the firing with addition of coal, the damper being adjusted to the requirements until all the air is driven from the boiler, and steam is escaping from the proper channel.

A period of at least two hours should be occupied in bringing the steam pressure in the boiler up to the pressure in header; as stated above, if the boilers are new a much longer time should be taken.

While steam pressure is rising in the boiler the gate valves between the boiler and the steam main should be slowly opened. This leaves the boiler still shut off from the main by the non-return valves. When the pressure on the boiler has reached the required pressure the non-return valve will open automatically, placing the boiler in connection with the main steam system.

Before commencing heavy firing, corresponding to the service in the remainder of the battery, lift the lever on the safety valve to see that it is free to act, and observe at the earliest opportunity whether this valve lifts at the allowed pressure of the boiler or under that pressure.

At this time the stop valve in the boiler feed pipe near the feed main of the boiler house should be wide open, also the stop valve between the check valve and the boiler; the feed controlling valve should be adjusted by the water tender to an opening such as will provide the required water delivery.

Checking Fires

The practice of checking fires by opening fire doors so as to permit an inrush of great quantities of cold air into the boiler setting and to the stack is bad from an economic standpoint, and subjects the boiler and setting to undesirably rapid changes of temperature.

Instead of this it is suggested that ash doors, or other draft supply, be closed, and that, if further checking is necessary, dampers be closed. Finally, if necessary, open fire doors gradually.

Blowing Out Boilers

The bottom blow-off should be used at least once every twelve hours, the valves in the blow-off connections being left open for a period of one-half minute or longer, depending upon the character of the feed-water supply.

A boiler should not be emptied before the setting has cooled.

Laying Up Boilers

If for any reason a boiler is to be taken out of service for cleaning, etc., the following procedure should be observed:

Check the dampers and allow the fires to burn out, at which time the non-return valve will be seated; also close the gate valve in the branch next to the header and open the drains in the "goose neck."

Shut off the stop valves in the feed pipe.

Rapid cooling sets up undesirable strains in the equipment. Cool as slowly as time will permit. A small amount of air may be passed through the furnace to assist in the cooling. To do this open doors and dampers slightly.

After the boiler is cool the blow-off valves may be opened and boiler drained.

If for any reason the boilers are to be laid up indefinitely, the following precautions should be taken to provide for safe conditions when boilers are again put into service.

Thoroughly drain the drums and tubes and clean them inside and outside. Then completely fill boiler and replace covers which have been removed. This method is not practicable when boilers could freeze. In such cases, after cleaning boilers dry them thoroughly and place a pan of lime in each drum to absorb moisture. Do not replace manhole covers. Some companies prefer to clean and dry a boiler and then smear the inside of the drums and tubes with a heavy crude oil or fuel oil. This should be put on with a swab, and when putting this on in a drum an electric lamp should be used, and not an open torch. Drums and tubes should be left open. Mud drums, headers, and tube caps should all be cleaned and similarly coated.

In all places where freezing may occur, care should be taken to drain water from all parts or fittings, or, where these cannot be drained (as in the case of steam gauges) they should be moved and stood in warm places.

The above assumes that the boiler is separated from the main header by two valves, a gate and a non-return. In case this condition does not exist, or if the valves leak, a blind flange must be inserted between the boiler and header.

Cleaning Boilers

The blow-off valves, stop valve in the "goose neck" next to the steam header, and the stop valve in the feed pipe next to the feed header, should all be locked shut and the keys retained in the possession of the man in charge of the subsequent cleaning operations. Place on the handle of all of the above valves a suitable sign as follows:

"Man inside boiler: Do not touch."

Manhole covers may be then removed and the boiler opened up for cleaning. It should be an invariable rule that the man who enters the boiler for the purpose of inspection, and who is in possession of the keys locking the above-mentioned valves, must give the final assent for the return of the manhole covers to their places.

Previous to entering the boiler it is advisable to determine whether there is any gas or bad air present, by passing a torch or candle inside.

For locking the valves as advised above the following method is suggested: Make a loose cover for the hand wheel of the valve out of sheet steel. This cover is simply a circular box made in halves and hinged at one side, with a hole in the bottom for the valve stem. On the side opposite the hinge an arrangement is made for attaching the lock, so that the box can be locked shut. This box can be painted bright red, with the word "danger" in another color. For large steam valves, this box may also have a sleeve extension to cover the valve stem, thus preventing the use of a wrench on the stem of the valve.

Cleaning Boiler Settings

The cleaning of the setting of coal-fired boilers

(*Continued on page* 146.)

Tells History of By-Product Gas Business

Elaborate Advertisements Used in Telling Story

Probably in the history of the by-product gas business in America, the public has not had a chance to see behind the scenes into the inner spaces of the coke business such as is being given just now to the citizens of Indiana by the Citizens Gas Company, of Indianapolis. The JOURNAL has told the public something of the start of this unusual campaign of education of a buying public, but later developments in it are of interest not only to the buyer of coke, but to the user of by-product gas as well. The Indianapolis company, in the most elaborate series of statements that a utility company ever has used in Indiana, is telling its consuming public all about the exigencies of the coke and by-product gas business It is buying space lavishly in the Indianapolis newspapers to bring about the fullest understanding of the many problems it faces in marketing its coke to any sort of advantage and in thus keeping the price of gas at the abnormally low price of 90 cents a thousand cubic feet, in accordance with the recent order of the Indiana Public Service Commission, allowing the company to increase its rate for the by-product gas to 90 cents from 60 cents a thousand cubic feet.

The series of statements from the gas company would make a treatise on the problems relating to the coke business which, published in book form, would be read by every student of the gas industry in America. Yet the Indianapolis company is preparing these statements, at great pains, merely for the purpose of educating its public to a more thoughtful turn of mind towards its big gas utility. For instance, there is such vast detail in the discussions that one of them was devoted entirely to "How Domestic Coke Business Is Related to Industrial Coke Business." This statement followed one in which it was made clear that the company's former rate of 60 cents on gas was "made possible only by adoption of a process which involved a large production of coke." The statement follows:

Total Coke Production

"We have explained that the production of 60-cent gas was made possible only by adoption of a process which involved a large production of coke. For every 1,000 cu. ft. of gas, about 300 lb. of coke had to be sold. For the present gas requirements of Indianapolis, complete dependence upon by-product coke ovens would mean an output of over 500,000 tons of commercial coke a year. The actual coke sales in 1920 amounted to 487,201 tons, and a great deal of gas was produced by another and more expensive process. Even at the inception of the business we had to market 100,000 tons a year.

Coke Revenue

"There are those in Indianapolis who think that this whole vast tonnage should be sold here as domestic fuel at a price comparable with the price of Indiana bituminous coal. This is a dream which can never be translated into reality. To attempet to do so would mean that the city would be deprived of both its by-product coke industry and its cheap gas. In other words the entire coke plants would soon disappear and all gas would have to be produced by more expensive processes under which gas consumers would have to pay the entire cost of production. No industry can exist long unless it is a commercial success. As previously explained, we embarked on a highly competitive industry only after we had convinced ourselves that a large tonnage of coke could be sold at remunerative prices. This involved the manufacture of coke of a grade that could be sold at remunerative prices. This involved the sale of a larger tonnage than Indianapolis domestic fuel buyers would probably take at any price, and it involved getting a higher average price for the total output than they would pay for any considerable tonnage. The average prices which we have always obtained for our total output in any year have been much above the prices at which we have sold our coke as domestic fuel in Indianapolis in the same year. Yet our profits have never been excessive. Indeed, they have never been large enough to leave us an adequate reserve for the present period of depression. People who think we should have sold domestic coke in Indianapolis at a lower price should note that if we had sold much larger quantities at the same price, we shou'd now be out of business.

Proportion of Domestic to Industrial Coke

"Both the necessity of finding a wide market for the large coke output of our ovens and the necessity of getting a revenue to keep us in existence forced us to manufacture a considerable proportion of our coke for industrial purposes—chiefly to supply metallurgical industries. The proportion of our output sold to metallurgical industries—foundries, blast furnaces and brass foundries—has ranged from 60 to 68½ per cent of our total commercial coke. Even at the present time of industrial depression, when most of our customers are nearly prostrate, a little over 60 per cent of the shipments we are able to make goes to metallurgical industries. In addition to this class of business we also supply coke to water gas plants and numerous other industries—the proportion of total output going to such purposes usually being 10 per cent or more. This means that the proportion of our total output of coke selling as domestic fuel has averaged around 25 per cent.

Desirability of Domestic Trade

"The fact that our domestic coke business has absorbed a comparatively small part of our output and has yielded comparatively a still smaller revenue does not mean that we do not consider it important. We believe that a diversification of our coke business is highly desirable, and that the domestic branch of it is important and worthy of consistent development. How it has developed; how it has been interrupted;

the special difficulties in the way of its local growth; and the methods necessarily employed in Indianapolis—will be the subject of further statements."

This statement gave such an immense vision of the wide distribution of the market for coke and the inability of any coke-producing company to ever bring the cost of coke down to a basis with domestic coal that the education of the buying public (that part which consumed a part of the domestic output of the company's coke) was much further advanced after reading it. Then the company, in a subsequent statement, launched into a discussion of "What Is Domestic By-Product Coke?" It said:

"Some people who are not familiar with the manufacture of coke have assumed that the coke which we sell as domestic fuel (about 25 per cent as explained yesterday) is merely refuse coke.

"There is much to justify such an assumption: Domestic coke is a by-product in the manufacture of foundry coke. But so, also, is gas and other valuable products of such an operation. A ton of coal cannot be converted into a ton of foundry coke. As a matter of fact, less than a half-ton is usually produced. But all of the other products of the ton of coal are available.

"Domestic coke is obtained by removing from the total coke product the smaller sizes and certain softer pieces which do not have the strength required for foundry practice. Much of the smaller material is suitable for many uses besides domestic fuel, and the softer pieces are entirely suitable for blast-furnace uses as well.

"In the preparation of domestic coke the material described above is crushed and sized to meet the requirements of various kinds of appliances used in homes.

"Now if domestic coke were not produced as a by-product of the highest grade of foundry coke, it would not be as good a fuel as that which we sell. To meet the requirements of the most exacting foundry trade we must use coal of the very best coking quality. Two or more kinds of coal are blended. They must be very low in ash and sulphur, and the ash must be non-metallic and fusible only at very high temperatures. Such coals are not only more expensive than many others at the mines, but bear higher freight rates as well. Without a market for premium foundry coke, it would be impossible to use such coals in the manufacture of domestic fuel.

"Thus it appears that the domestic fuel buyer and the producer are equally benefited by the manufacture of domestic coke as a by-product of foundry coke. The former by being able to obtain a fuel which is very high in fixed carbon at a price which is seldom above the bare cost of the coal out of which it is made; the company by being able to select its metallurgical coke with care and yet have a market for its remaining coke.

"Not all of this remainder has to be converted into domestic fuel. Not all of it should be. But it is to the interest of the company to maintain and extend its markets for domestic by-product coke by all reasonable means."

Then the company set out to prove definitely that the charge against it that it had not cultivated the local coke market (this charge was heard often during the long case before the Public Service Commission) was not appropriate. To do this it purchased enough space in the newspapers to show graphically in a chart that the monthly sales for Indianapolis domestic use grew from nothing at the end of 1909 to nearly 4,000 tons in the month of August, 1917. The company said in its preliminary to the chart, which was printed in every Indianapolis newspaper on the subject:

"Starting with nothing in December, 1909, the company was able to develop a business which grew steadily until after the middle of 1917, when the war activities of the U. S. Government, the regulations of Government agencies and the shortages of coal placed a check on the business from which it has not yet fully recovered.

"The establishment of the business in Indianapolis was not easy. The fuel requirements of a community are, at any given time, relatively fixed. People buy fuel only to burn and nothing can cause them to increase their consumption. The demand for coal is inelastic. We found Indianapolis a soft coal town—the vast majority of the people using local coal. A very small proportion were using anthracite coal, gas-house coke and Pocahontas coal. Our first step had to be to substitute by-product coke for these better grades of fuel. Only gradually could users of the cheap local coals be induced to buy the higher grades of fuel which, although much more economical than their prices indicated, were considerably higher per ton than the local soft coals.

"The monthly sales for Indianapolis domestic use grew from nothing at the end of 1909 to nearly 4,000 tons in the month of August, 1917. This was not sensational but, under all of the circumstances, it was encouraging. Then came the regulations of the Government diverting coke to meet national emergencies, and those lasted to the end of 1918. The local business could not grow, but on the other hand it shrank. After the signing of the armistice nobody wanted to buy either coal or coke because stocks of fuel had become so large and industry had suffered such a check. From the early fall of 1919 to November, 1920, there was a fuel panic. Everybody then wanted to buy fuel, but there was not enough to go around. The miners' strike in November and December of 1919 and the railroad strikes of April and May of 1920 increased the scarcity and the buyers' panic.

"This company, in common with all other large users of coal, was unable to obtain sufficient supplies. Both gas and coke production were curtailed. Coke due to contracts had to be prorated in accordance with the reduced output, but the company supplied the Indianapolis trade with the full amounts for which dealers had contracted, although local prices were much lower than those obtainable elsewhere. During the miners' strike much larger quantities were made available for the people of Indianapolis, local shipments in December, 1919, mounting up to over 9,000 tons. The past mild winter and general depression have again reduced local demand, but the Indianapolis shipments in the first quarter of 1921 have amounted to 5,030 tons as compared with 1,643 tons in the first quarter of 1919, and the shipments in April of this year have been 3,921 tons as compared with 1,311 tons in April of 1919. Although the present depression is more serious than that of 1919, the local coke sales indicate that we are getting back to the normal line of development which was broken in the fall of 1917."

On the next day the company's statement to the

public continued the "Growth of the Indianapolis Domestic Coke Business," with a graphic representation of the annual tonnage development of the local trade; the purpose of these statements being to disprove the constant criticism that Indianapolis by-product coke is being sent to other markets, rather than the home market.

While the Indianapolis company has been making heroic efforts to assure its own public that it desires a local market for its coke, a newspaper of its home city sent a staff correspondent to St. Louis, Mo., for an investigation of the coke situation there. Of that much interest in the big Indiana capital is the whole coke and gas problem just now. Here is what the man found, who investigated the St. Louis situation, as related to Hoosiers in his own words:

"St. Louis, Mo.—Coke, produced at a greater expense than the by-product of the Citizens Gas Company of Indianapolis and said to be of a better grade is being offered in the open market of St. Louis at a price less than that asked for coke in Indianapolis. The M. W. Warren Coke Company, which occupies the same position to the Laclede Gas Company of St. Louis as does the Domhoff & Joyce Company to the Citizens Gas Company, is making sidewalk delivery of coke at $10 a ton.

"P. H. Woods, vice-president of the Warren company, says his concern is not making much money by selling coke at that price. But it was absolutely necessary to create a market for coke, he declared, and in order to so do the price had to be brought down to a figure that would attract all classes of fuel consumers. He explained that the bulk of the St. Louis fuel supplies was drawn from the Illinois coal fields and that this Illinois coal is of a poorer grade and commands a lower price than that used in Indianapolis.

" 'Therefore, you can readily see that we have to sell our coke for less than the Indianapolis dealer or get out of the market,' Mr. Woods said. 'We can't compete with low-priced coal, even though our fuel is much cleaner and, in addition, has numerous other advantages.

" 'People generally do not understand what an excellent fuel coke really is,' he continued. 'Its cleanliness alone is a big factor in its favor and does commend it to many buyers, but the average man overlooks this feature since the city authorities pay little or no attention to the smoke and dirt nuisance. It is dollars and cents that interest him. If he is able to get a fuel a little cheaper, even though it is smoky and dirty and more difficult to handle, that is the fuel he buys. We would have easier sailing if the city had a more stringent smoke inspection department. It was better before the war, but, like so many other things, the smoke inspection department went more or less to seed during that period.'

"He said his company rather looked to the women's clubs to help them out on the smoke question. That is that the women would lead some move to abate the smoke nuisance.

"The higher production cost in St. Louis, he declared, was due to the fact that both the Indianapolis and St. Louis gas companies obtained their gas coal supplies from the same fields—eastern Kentucky and West Virginia—and that the longer haul with the additional freight charges made the coal more expensive for the St. Louis Company.

"Mr. Woods explained that the advantages of coke as a fuel for manufacturing and domestic use, are being brought to the attention of the public by advertising, personal solicitation, demonstrations and then with a follow up campaign that is meeting with considerable success.

On the first floor of the Laclede Gas Building, where consumers go to sign contracts and pay their bills, a large coke exhibit is maintained. This exhibit is housed in a booth and consists of samples of coke made from the various grades of coal used by the gas company. The prices are plainly set out. There is one grade that sells for $9.75, but the Warren company, which has offices in the gas building, is making its campaign on the $10 coke. Coke and coal as fuels are compared in statistical tables, with the odds in favor of the former for heating value and cleanliness and there is a man in attendance to answer questions.

"The St. Louis gas situation is similar to that in Indianapolis, only more so. A hike in rates recently was authorized by the Missouri Public Service Commission, but what that rate is seems more or less of a mystery to the general public. Not one of half a dozen persons asked at random on the street was able to tell the rate.

"The reply to the question, 'What is the gas rate in St. Louis?' was practically the same in each case: 'Well, I don't know exactly, but I'm a consumer, and you can bet it's high enough.'

"A general office employee of the company said the rate was $1.05 'net.'

"G. B. Davis, general manager of the Laclede Gas Company, volunteered the information that if the commission had not granted the increase when it did that the company would now be in the hands of a receiver.

"Mr. Davis also indicated that the coke market largely was to blame for the present difficulties of so many gas companies.

" 'During the war,' he said, 'when production was booming, coke was in great demand. In fact, we couldn't produce enough to keep up with the calls. The result was that the small consumer was squeezed out and the prices of coke soared to unprecedented figures. Then along came the lull and coke became a drug on the market. When we went out to try to sell it, we were laughed at. We couldn't give it away.'

"But there was one advantage to this war use of coke, according to Mr. Davis. He says it kept the gas rates from being hiked before they were. He also says that the higher the price of coke, the cheaper the rate for gas.

" 'But what good,' he asked, 'is a coke pile of so many hundred thousand tons at $10 or $12 or $15 a ton if you can't get rid of it? Just as bad as none at all, isn't it? We are trying to get around that condition by asking less for our coke and getting it moved, even though it means a loss to the company.'

"Mr. Davis would not discuss costs, saying that was a matter that he preferred leaving to the Warren company, 'which handles all our coke business the same as the Domhoff & Joyce Company handles the Indianapolis Gas Company's business.' Just what the Warren company pays for its coke was not learned.

"Both Mr. Davis and Mr. Woods seemed familiar with the Indianapolis situation, especially Mr. Woods, who was one of the outside experts called in

(*Continued on page* 146.)

Trent Process of Cleaning Coal

An Explanation of Results Obtained by Experiments

By G. H. J. PERROTT and S. P. KINNEY

When a mixture of pulverized coal and water is agitated with oil in an amount equal to 30 per cent of the weight of the coal, a clean separation of a considerable part of the mineral matter is obtained. The carbonaceous material forms with the oil a pasty agglomerate which is heavier than water, while the mineral matter which was physically separated from the carbonaceous material by the fine pulverization remains suspended and can be drawn off with the water.

Historical

The history of coal washing has been similar to that of ore concentration. Hand picking has been supplanted by jigs, jigs have given way to tables in the treatment of the finer sizes of coal, and of late much attention has been given to the possibilities of froth flotation and other methods making use of the selective action of oils.

Bacon and Hamor, in discussing the problem of the utilization of fuels, describe experiments carried on at the Mellon Institute by Dr. C. B. Carter on froth flotation of coals. He found that the combustible matter contained in washer waste of all grades could be almost completely removed by suitable oil flotation, with a recovery of combustible matter between 70 and 90 per cent. Best results were obtained with washer waste crushed to pass a forty-eight-mesh screen. The coal particles showed maximum floating properties when they were sharp, angular, and lustrous. Grinding in machines of the disk type was found to destroy these physical properties and to make the yield of recovered coal from refuse ground in this manner small and its ash content high. Estimates showed that a plant to handle 500 tons daily of ordinary bituminous coal washer waste would cost $135,000. With such an installation, it was estimated that coal could be obtained from refuse containing 65 to 70 per cent ash to the extent of 75 per cent of the total coal present, in the form of dry 25 per cent ash concentrate at a cost of $1.84 per ton. Pyrite was found difficult to remove by froth flotation.

Ernest Bury and coworkers describe an investigation of froth flotation of coal carried out at the works of the Skinningrove Iron Company, England. These workers were able to obtain concentrates analyzing 9 to 14 per cent ash from washery wastes containing 40 to 75 per cent ash. The tailings contained 76 to 89 per cent ash. The authors believe that a considerable amount of pyrite may be removed by the process, although no sulphur analyses are given. The washed product, which forms as a thick, heavy, stable scum on the water surface of the froth boxes, contains about 50 per cent of moisture. This concentrate is discharged into revolving filters of the Oliver type, drained under suction, and discharged as a filter cake containing 10 to 15 per cent of moisture. The cost of cleaning coal by froth flotation is estimated as not greater than the cost of jig washing. In regard to the scope of froth flotation in coal cleaning, the authors state as follows: "The flotation method does not, of course, compete with washers treating nut coal for sale on the open market for boiler firing, etc.; it can be employed only where the original coal is fine or where crushing is part of the normal treatment—that is, for coking, gas making, briquetting, coal-dust firing, colloidal fuel, etc."

Nature of Mineral Matter in Coal

The mineral matter in coal is classified (1) according to its physical state of subdivision as "intrinsic" and "extraneous," and (2) according to its chemical composition as shale, clay, "slate," sand, calcite, and pyrite. Intrinsic impurities are those which are present in a very fine state of dissemination throughout the coal substance and are not separated from the coal substance even by very fine pulverization. This intrinsic mineral matter is partly derived from the original material and partly deposited during the laying down of the coal bed from external sources by sedimentation and precipitation. Extraneous impurities occur in the form of partings, veins, and nodules, or may be impurities mechanically mixed with the coal during the process of mining. Part of this extraneous mineral matter is removed by the standard methods of washing coal, the amount removed depending on the fineness of crushing necessary to physically separate mineral matter from coal substance, and on the size of crushed coal which the washery can efficiently treat.

Differences Between Coal and Ore Concentration

There are certain obvious difierences between concentrating coal and concentrating ore. In ore concentration the valuable material is heavier than the gange and constitutes a small percentage of the total material treated. In coal concentration, the valuable material is lighter than the refuse and constitutes a large percentage of the total material treated. Furthermore, there is a larger difference in specific gravity between values and gangue in ore than in coal. Gangue in ore varies in specific gravity from 2.5 to 3 and values vary from 4 to 8, while the mineral matter in coal (with the exception of pyrite) varies in specific gravity from 2 to 2.7 and the clean coal concentrate from 1.2 to 1.7. Again, coal contains extraneous mineral matter easily separated by crushing and intrinsic mineral matter, none of which can be separated except by very fine pulverization. The crushed raw coal which is to be concentrated may contain particles of coal of varying gravities containing varying amounts of inseparable ash, making a clean separation impossible at the degree of fineness employed with ordinary washing methods.

Since the further history of the coal concentrate is to be different from that of the ore concentrate, it does not necessarily follow that methods using relatively large amounts of oil are impracticable for concentrating coal even though such methods have been practically abandoned in ore concentration practice.

The ore concentrate is to be passed through a metallurgical operation for the recovery of the pure metal; the coal concentrate is to be used ultimately as a fuel and in many cases is to be subjected to distillation for the production of coke. The mixture of coal and oil may be burned without further treatment or it may be carbonized with the formation of coke and recovery of the oil and by-products from the coal. If the oil employed contans a considerable percentage of pitch, it may serve to make coherent coke from feebly coking coals.

Scope of the Bureau of Mines

The work at the bureau has been carried out rather on the fundamentals of the bulk oil method than on its economic aspects. Experiments on a laboratory scale have been made to determine for a variety of coals the ash and sulphur removal, combustible recovery, and oil losses with different oils, different methods of agitation, and various degrees of fineness of pulverized coal. The experimental procedure followed has aimed to obtain data giving a complete balance sheet of the process.

Theoretical

The bulk oil method of cleaning coal depends upon the same principles of selective wetting which have made possible froth flotation of ores and have been voluminously discussed in the literature of flotation. When oil is stirred into a suspension of coal in water, the first tendency is probably the formation of a suspension of droplets of oil in the mixture. The coal particles are, however, so readily wet by oil in preference to water that the globules rapidly become small agglomerates of coal and oil. These agglomerates tend to adhere to one another, entrapping water in the spaces between them and forming the pasty mass which precedes the "breaking" of the mixture. As a result of further agitation, the small agglomerates coalesce into larger granules and finally coalescence reaches a point where a large amount of water is released from between the particles and the separate granules are visible. With further agitation, the granules agglomerate into larger masses and if sufficient oil has been added, finally form a more or less homogenous mass.

The best conditions for rapid formation of this "amalgam"* are (1) low surface tension between coal and oil, (2) a high surface tension beteween coal and water, and (3) a high surface tension between oil and water. Or, in other words, the reaction will take place most readily (1) with a coal which is very readily wet by oil, (2) with a coal which is not readily wet by water, and (3) with an oil which does not readily form emulsions with water. From (1) and (2) we should expect that the bituminous coals and graphite should respond to treatment most readily and the lignites least readily. From (3) we should expect gasoline and the higher paraffin oils to form an "amalgam" more readily than benzol and the higher aromatics and that the presence of substances in water or oil which tend to lower the surface tension between water and oil, would make the formation of the amalgam more difficult. Particles of refuse which have been physically separated from the clean coal particles by the preliminary pulverization, will be easily removed if they are readily wet by water in preference to oil, and removed with difficulty if they have any tendency to be wet by oil. Hence we should expect that shale, clay and gypsum would be readily removed suspended in the water but that pyrite might tend to remain in the amalgam.

*In ordinary technical usage, amalgam refers to an alloy of a metal with mercury, but the term is correctly used, according to Webster's Dictionary, to refer to any "mixture, compound, or union of different things."

Methods and Apparatus for Laboratory Scale Work

Coal is pulverized to pass a sixty-five-mesh screen in a laboratory disk crusher. For finer meshes the coal is then ground in a porcelain ball mill with an equal weight of water, for periods varying from four hours to as long as sixty hours when extremely fine grinding is desired (as fine as 800-mesh has been obtained in this manner). The coal is washed from the ball mill into a settling jar, from which after settling has taken place and some of the water has been decanted, it is transferred to a small electrically stirred glass churn. Three-hundred-gram samples of coal have been employed in most of our work and have been agitated in the churn with about 900 c.c. of water. A sufficient quantity of oil is added—about 25 per cent of the weight of the coal for a coal containing 25 per cent removable refuse—and agitation is carried on until the agglomerate of small egg-shaped granules known as the amalgam is formed.

The amalgam and water and suspended refuse are poured on to a 100-mesh screen and washed with water. The amalgam is then placed in the churn and washed with fresh water and the process repeated until no further mineral matter is removed.

After the amalgam has been separated from the refuse and the refuse filtered on a weighed paper, the products for analysis are:

Amalgam, consisting of purified coal, oil, and 10 to 30 per cent water.

Refuse, consisting of mineral matter, a small amount of combustible matter, oil, and water.

Refuse water, consisting of all the water used in the process with the exception of that retained in the amalgam and filtered refuse, a small amount of dissolved mineral matter, and under certain conditions possibly emulsified oil.

Before analysis can be made, both amalgam and refuse must be separated from oil and water. This separation must be done in a quantitative way so that oil losses, if any, may be determined. The obvious way of separating the oil is extraction of amalgam or refuse with a solvent which dissolves the oil but does not affect amalgam or refuse. If this solvent boils at a higher temperature than water, the water may be condensed and measured, thus determining amounts of oil and water in one operation. Due to the large amount of water in amalgams and refuse and the difficulty of accurately sampling the wet amalgam, it has been found more practicable to subject the whole amalgam and refuse to a separate distillation at 110 deg. Cent., in which water is caught and measured. The dry material is then extracted with benzol to determine the percentage of oil. When a volatile liquid such as benzene is used in making the amalgam, distillation determines the amounts of both water and benzene and no extraction is necessary.

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As the Journal Views It

An Improved Situation

Financial leaders in the United States are of the opinion that there is to-day a greater public confidence in the securities issued by public utilities than there ever has been. According to the reported remarks of these leaders every issue is being readily subscribed by the public and these securities are being held for investment.

Reports received from various parts of the country also indicate that there is a ready market for a good issue by a public utility. This is very encouraging to those companies that have been planning to make extensions to their equipment but have been unable to finance these necessary additions. With the money available at rates that are not excessive, considering present conditions, there is an opportunity to extend our business such as never has been presented.

One of the large financial institutions of the country is at present advertising to investors that they have an attractive list of public utility securities that are so priced as to offer a good return and at the same time solid security.

With money available it would seem that the depression which has gripped the country for some several months, is about passed and that this industry can look forward to a resumption of its progress

According to those who are in a position to know there should be a reduction in the cost of materials within the near future that will allow for companies to make a reasonable return on their investments. It is to be hoped that this is correct, for it will mean that prosperity will once again smile upon us. Naturally as materials are reduced we can expect that we will be importuned to reduce our rates, but we be-

live that an explanation setting forth the real facts in the case will show the public how impossible it is to lower the rates and continue business.

From the knowledge which has reached us we venture to say that not one company in the gas business to-day is making any more than a bare profit and that with most companies able only to pay carrying charges that the only way that rates can be reduced is for a material lowering of the B.t.u. standards and for a marked reduction in manufacturing costs.

But withal the future looks brighter than it has for some time, but, as is always the case, we must not expect that we are going to be able to share in the prosperity unless we are willing to work for it.

The A. G. A. Convention

Considerable interest is being shown in the annual convention of the American Gas Association which will take place during the week of November 7, in Chicago. We are advised that practically the entire gas industry will be represented in the meeting and that the attendance will break all records. That is splendid and the AMERICAN GAS JOURNAL believes that the trip to Chicago will well repay those who take it.

There have been some remarkable developments during the past year and it is essential that gasmen should be kept in close touch with the situation. The numerous papers that are scheduled for presentation and the discussions that will follow are of such a nature that even though the trade papers will cover it as fully as is humanly possible, there will be many sidelights that of necessity are omitted.

One of the features of all of the A. G. A. conventions is the exhibits of appliances and equipment. This year, this feature, as all others, will be unusual in that it will be extraordinarily complete. In this division of the gas business there also have been some remarkable developments and a thorough inspection of the exhibit will do much toward keeping the gasman in touch with the newer devices.

It is to be hoped that this coming convention will do a great deal toward helping to solve some of the problems of the business.

Among the various attractions that will be presented are the reports of the various committees. During the past year these committees have been at work on various problems. Their reports will be interesting and instructive and such recommendations as are made will also be of great help.

While the AMERICAN GAS JOURNAL has no authoritative information on the subject it is supposed that the committee on rate structure, than which there is no more important subject, will make a report which will contain a great amount of useful information. Everybody should attend the conventions!

Tells History of By-Product Gas Business

(*Continued from page* 142.)

the Indiana Public Service Commission and questioned as to the value of coke when the petition of the Citizens Gas Company for a hike in rates first came before the commissioners several months ago.

"Mr. Woods registered a lively interest in the value of $8 a ton set on Indianapolis coke by the service board and said that if he were to testify now he probably would not name a figure as high as the one he did when he was in Indianapoliis. His valuation was in the neighborhood of $7.50 a ton, and he contended that that price was approximately correct at the time.

"The St. Louis coke market promises to become more interesting before long. The Laclede Gas Company has been for a long time practically the only producer of coke and still leads in production, but there is a concern known as the St. Louis Coke & Chemical, at Granite City, just across the river, which will bear watching."

Thus does the readjustment process affecting the whole Indianapolis gas and coke situation goes forward. Meanwhile the public is becoming deeply interested in the often reiterated statements that the Citizens Gas Company is about to surrender its franchise to the Public Service Commission of Indiana and accept in lieu thereof an indeterminate permit for the operation of its business, under the terms of new legislation, enacted at the last session of the General Assembly in Indiana. The Indianapolis Street Railway Company is involved in much the same sort of a discussion and at last the city board of works announced that it would confer with the Public Service Commission to determine just how such surrenders would affect the city's relation to the utility properties. The laws of the last Legislature were promulgated by the Governor late last week and the companies now are free at any time to surrender their franchises and pass directly under the governing power of the commission. Much interest has been aroused over the situation and the eyes of the gas industry throughout the country are focused on Indianapolis because of the many and rapid developments in the readjustment of Indiana's big gas utility to post-war conditions.

Boiler Rooms

(*Continued from page* 139.)

should not be commenced until all the flue dust and other material, also the walls of the settings, have been cooled to a temperature where there is no possibility of a man being burned by touching them.

The cleaning of gas-fired boilers will necessitate an additional precaution in the way of testing the chambers by means of lighted candle or torch to detect the presence of gas or bad air before a man undertakes to operate therein, and, furthermore, the gas valve leading to such a boiler should be locked shut and the key retained in the possession of the man in charge of the subsequent cleaning operation. A sign: "Man inside boiler: Do not touch," similar to that to be placed on the steam feed and blow-off valves, is to be placed on this valve also.

Leaks in Steam Pipe Systems and Other Structures Under Pressure

If for any reason, such as blowing out of gaskets, vibration, overstraining of pipes or general deterioration, the joints of steam pipes develop objectionable leaks, the application of wrenches to bolts of such joints while under steam pressure should be absolutely prohibited. If such joints are to be repaired it should be done after the pressure has been removed from the particular section where the trouble occurs.

If the tubes of a fire-tube boiler develop leaks at the tube sheet, expanders should not be applied to the ends of the tubes while the boiler is under steam pressure.

If a leak develops at any part of the sections of a boiler, whether in the headers to which the tubes are attached or at a riveted joint, the use of a calking tool to stop this leak while the struceure is under steam pressure should be prohibited. This applies to rivets as well as plates. All such repairs should be made after the steam pressure has been taken off the boiler.

If a leak develops at the hand-hole plate or around the tube caps of water-tube boilers, same should not be stopped by tightening up the bolts while steam pressure is on the boiler.

If a leak develops at a manhole cover it should not be stopped by tightening the bolts in the yoke while the boiler is under steam.

Stop-Valve Stems

Rising stems of valves should not be permitted to become rusty or covered with dirt so that they cannot be moved the full extent of their travel at any time. A periodic inspection, not less than once a month, of all valves, stems, etc., in all the main piping systems about the boiler house is recommended. Too much importance cannot be attached to keeping the valves in such condition that they are always ready for use.

Great care should be exercised in using a wrench or bar in opening or closing a valve. The abuse of this means of facilitating the handling of valves may result in damage or accidents to seats, threads, stems, etc.

Turning Steam Into Empty Sections of Piping

Steam should always be admitted to empty piping *very* slowly.

If any portion of piping has remained unused for an hour or more it is important that it be completely drained before steam is again turned into it.

The Care and Use of Water Columns and Try-Cocks

Water columns should be blown out completely at least twice every turn. If a gauge glass is fouled internally, so that the water level is not clear, the glass should be cleaned or replaced as soon as possible. If the fouling of the gauge glass occurs frequently, it is due to some characteristic of the water, such as suspended matter, scale solvents, lubricating oil, etc., for which some remedy should be devised.

Try cocks shall be used at least twice every turn, which regular use will keep them in good working order.

Team Work

In every well-ordered department it is the duty of specified workmen to operate certain valves in case of accident. Where there is both direct and indirect control of important valves, team play should be installed to reach both controls at the earliest moment. Gates and valves are occasionally found depending entirely upon indirect control. Direct control should also be provided.

No one should be allowed to remain unnecessarily in a boiler-room. Visitors are not only in danger if an accident occurs, but are likely to distract the attention of the boiler-room employees and cause them to neglect their important duties.

Good ventilation should be provided for basements and subways to boiler-rooms. In these places there is grave danger of the accumulation of noxious gases.

Remove or minimize every stumbling hazard in the boiler-room. Tools in racks, steam hose in its place, proper drainage of wet places, and safe disposal of fuel—all will prevent accidents.

Scale in boilers causes bulges and ruptures of boiler shell—usually leading to explosions. Remove the scale frequently.

When a boiler is shut down for repairs or cleaning, the stop valves in main steam connection should be securely locked with a padlock. After the boiler is drained, the blow-off valve should also be padlocked.

Test each Safety valve at least once a day to see that it is working properly.

Never exceed the safe working pressure allowed for each boiler as given on the inspection certificate.

Do not allow spare parts and material to accumulate in out-of-the-way places about the room—return them to the storekeeper. They may cause a slip or a trip, or may fall and injure someone.

The Trent Process of Cleaning Coal

(*Continued from page* 144.)

Even when heavy petroleum oils are used in making the amalgam, it is best to dry in the still because a small portion of the oil always comes over with the water. Drying in an open dish would thus give rise to an unaccounted for loss of oil.

Ash Reduction and Combustible Recovery

In calculating the efficiency of the process, several values are of interest, three of the most important being (1) per cent ash in the oil-and-water-free cleaned coal; (2) per cent ash reduction, (3) per cent combustible recovery. The first two values are qualitative measures of the efficiency. By per cent ash reduction is meant the ratio between the ash in the cleaned coal and the ash in the raw coal. Per cent combustible recovery is a quantative measure of the efficiency of separation of combustible matter from mineral matter. It is equal to C —rc ÷ C, where C is the per cent combustible matter in the raw coal, c the per cent combustible matter in the refuse, and r is the per cent refuse by weight of the raw coal.

In calculating the amount of combustible matter in coal or refuse, it must be borne in mind that combustion of carbon is not the sole reason for loss in weight when coal is ignited in the analytical method for determination of ash. There is always a larger amount of mineral matter in coal or refuse than represented by the percentage of ash as determined by the ordinary analytical method. For example, a refuse which shows 85 per cent ash remaining after ignition to constant weight at 750 deg. Cent. does not contain 15 per cent combustible matter. Several factors contribute to this loss in weight.

Combustion of carbonaceous material.
Decomposition of carbonates.
Oxidation of pyrite to Fe_2O_3 and SO_2, and combination of part of the SO_2 with oxides formed from decomposed carbonates.
Loss of water of hydration from clay and shale.

Water of hydration varies from 2 to 12 per cent of shale. Calcium carbonate is present in small amounts in the coals of the Appalachian fields, but may run as high as 50 per cent of the ash of some of the Illinois coals. Parr (Parr, S. W., Preliminary Report of Committee on Coal Analysis; Jour. Ind. and Eng. Chem., vol. 5, June, 1913, p 523) has proposed the following formula for calculating the corrected ash:

$$\text{Corrected ash} = \text{Ashw} - 3C_1 + 5S \div 8 + 0.08\,(\text{Ashw} - (34C\,1 \div 3 + 10S \div 8))$$

Where Ashw = per cent ash as weighed after ignition at 750 deg. Cent. with addition of H_2SO_4,
Cl = per cent carbon occurring as carbonate in the unburned coal,
S = per cent sulphur in unburned coal.

In our work, time has not been available for determination of carbonate in the refuse and the corrected ash has been determined as follows:

$$\text{Ash corrected} = 1.08\ \text{ash} - 21S \div 40$$

Any correction factor must of necessity be an approximation, the correctness varying according as the composition of the ash varies from the assumptions made in deriving the formula. The water of hydration which is present in shales may vary from 2 to 12 per cent. Part of the sulphur is present as organic sulphur, while the formula assumes the sulphur is all present as pyrite. Since little organic sulphur is removed with the refuse, the sulphur correction is fairly accurate.

Table I gives a description of the coals discussed in the present article. These coals are referred to in the remaining paragraphs as noted in the column under "Designation."

Table II gives averages of results with a number of typical coals of the United States. The coals were pulverized to 65 mesh and ground for six hours with an equal weight of water in a laboratory ball mill before treatment by the Trent process. The oil employed was in all cases a grade of navy fuel oil running 125 seconds on the Saybolt viscosimeter at 25 deg. Cent. The specific gravity of the oil was 0.875 (30.0 deg. Baume) at 20 deg. Cent.

The results as set down are for the most part self-explanatory. It will be seen that ash reduction with most of the coals tested is good, varying from 30 to 75 per cent. Sulphur reduction is fairly good in the case of anthracite coals but low i nthe case of bituminous coals. With these latter coals just sufficient sulphur is removed to keep the sulphur content of the recovered coal about the same as that of the raw coal. Combustible recovery is with a few exceptions better than 95 per cent.

Sulphur Removal

The removal of pyrite from coal by any process depending on the selective action of oils is considerably more difficult than the removal of other mineral matter such as shale or slate. Pyrite is readily wet by oil and particularly when i na fine state of subdivision tends to attach itself to the coal-oil agglomerates rather than remain suspended in the water. Separation is accomplished with greater ease from anthracites than from bituminous coals. This difference in behavior of anthracite and bituminous coals is shown clearly in the following analyses showing the percentage of total sulphur, sulphate sulphur, pyritic sulphur, and organic sulphur in a bituminous and an anthracite coal before and after treatment by the Trent process. It will be seen that in the treatment of anthracite coal, the pyritic sulphur almost disappeared from the recovered coal, while in treating the bituminous coal there was still a considerable percentage of pyritic sulphur remaining in the recovered coal.

		Analysis of Sulphur			
Oklahoma bituminous No. 75631:	Ash	Total	Pyritic	Sulphate	Organic
Raw	19.5	4.74	3.01	0.36	1.37
Recovered	7.9	3.75	2.10	0.15	1.50
Refuse	46.3	6.50	4.85	0.35	1.30
Penn. anthracite culm No. 76975:					
Raw	31.5	1.74	1.21	0.06	0.47
Recovered	7.0	0.85	0.13	0.07	0.65
Refuse	66.1	2.73	2.41	0.01	0.31

A study of synthetic mixtures of coal and pyrite

was made with a view to determining definitely the percentage of pyrite which might be removed from a mixture in which the pyrite was known to be separated from the coal particles. With mixtures of bituminous coal and pyrite ground to pass a 200-mesh sieve, separation of about 60 per cent of the pyrite was obtained by means of the Trent process, but practically no separation was obtained when this mixture was ground to 600-mesh or finer. Better separation was obtained with mixtures of anthracite and pyrite. The pyrite refuse separated from the various mixtures always retained considerable amounts of oil, pointing to the fact that where separation of pyrite was obtained in the coarser mesh mixtures, this pyrite was mechanically separated from the amalgam by reason of its high density and still retained a film of oil. Coal pyrite containing about 46 per cent sulphur was used in the experiments. It was found possible to make amalgam of the wet ground pyrite alone with very little of the pyrite remaining suspended in the water.

Results point to the desirability of preliminary water concentration of high sulphur coals for removal of pyrite before treatment by the Trent process.

Anthracite Culm 80%, Pyrite 20%

	% Raw Coal Mixture		% Recovered — Coal —			Refuse		% Sulphur Reduction
	Ash	S	Wt.	Ash	S	Wt.	Ash	
Mesh 100	34.5	9.90	70.4	16.0	3.40	29.6	67.7	66.3
Mesh 200	34.5	9.90	60.2	10.7	1.40	39.8	69.9	86.0
Mesh 600	38.0	10.40	57.0	9.9	2.80	43.0	77.3	72.8

Oil Employed in Process

Any oil or organic liquid not miscible with water may be employed in the Trent process provided its viscosity is not too great. The heavy topped crudes may be employed if the water used in the process is heated, thus reducing the viscosity of the oil. Certain commercial emulsions such as water gas tar or "B. S." petroleum emulsions have been successfully employed. Here again the viscosity must not be too great. B. S. refinery settlings of the consistency of cup grease were not found to be satisfactory at ordinary temperatures. An oil of viscosity equal to 135 seconds (at 25 deg. Cent.) on the Saybolt viscosimeter gives satisfactory results. When oils of viscosity equal to 400 seconds and upwards are employed, it is necessary to employ heated water to secure best results. Using an oil with a viscosity equivalent to 4,000 seconds Saybolt, at room temperature, it was found necessary to heat the water to 70 deg. Cent. to effect formation of the amalgam.

In the following table a series of test results are given in which liquids of increasing viscosity were used to clean the same coal:

TABLE I—DESCRIPTION OF COALS TESTED

Class of Coal	Seam	Source	Designation
Anthracite culm		Secured from Trent Process Corp., Washington, D. C.	Anthracite Culm I
Anthracite culm		Feed to concentrating tables at washery of Hudson Coal Co., Scranton, Pa.	Anthracite Culm II
Anthracite		Rhode Island anthracite	Rhode Island
Bituminous	Pittsburgh	Pulverized coal from plant of Oliver Iron & Steel Co., Pittsburgh, Pa.	Pittsburgh
Bituminous	Upper Freeport	Run-of-mine coal from Avenue Mine of Allegheny Steel Co., Brackenridge, Pa.	Upper Freeport I
Bituminous	Upper Freeport	Feed to washery at mine of Inland Collieries Co., Harmarville, Pa.	Upper Freeport II
Bituminous	Upper Freeport	Bone coal refuse from washery of Inland Collieries Co., Harmarville, Pa.	Bone coal
Bituminous	No. 6	Run-of-mine coal, No. 1 mine Superior Coal Co., Gillespie, Ill.	Illinois I
Bituminous	No. 6	Run-of-mine coal, No. 7 mine Big Muddy Coal & Iron Co., Herrin, Ill.	Illinois II
Bituminous	No. 6	Run-of-mine coal, No. 12 mine Vandalia Coal Co., Sullivan, Ind.	Indiana
Bituminous	Lehigh	Run-of-mine coal, No. 5 mine Folsom Morris Coal Mining Co., Lehigh, Okla.	Oklahoma
Bituminous		Run-of-mine coal from cars at mouth of mine, Wilkeson Coal & Coke Co., Wilkeson, Wash.	Wash. bituminous
Bituminous		Coal from Brazil, secured from Trent Process Corporation	Brazil
Bituminous refuse	Blossburg	Waste from washery of Phelps-Dodge Co., Dawson, N. M.	New Mexico
Bituminous refuse	Soddy	Washer refuse from washery of Durham Coal & Iron Co., Soddy, Tenn.	Tennessee
Bituminous refuse	Black Creek	Washer refuse from washery of Black Creek Coal Co., Nauvoo, Ala.	Alabama
Sub-bituminous		Run-of-mine coal from bins at head of washery plus bone from picking table, Pacific Coast Coal Co., Issaquah, Wash.	Wash. sub-bitu
Lignite		Run-of-mine coal, No. 1 mine Bertetti Coal Co., Lytle, Tex.	Texas lignite
Lignite		Run-of-mine coal, McKissick Cattle Co., Ione, Cal.	California lignite

SYNTHETIC MIXTURES

Upper Freeport Bituminous Coal 80%, Pyrite 20%

	% Raw Coal Mixture		% Recovered — Coal —			Refuse		% Sulphur Reduction
	Ash	S	Wt.	Ash	S	Wt.	Ash	
Mesh 100	17.9	9.72	91.4	12.7	5.61	8.6	65.7	42.1
Mesh 200	17.9	9.72	85.5	10.3	3.89	14.5	66.2	60.0
Mesh 600	17.9	9.72	98.8	17.2	9.47	1.2	85.5	7.6

ANTHRACITE CULM 76975

Kind of Oil Used	Amt., Gals. per Ton	Viscosity at 25° C. Seconds Saybolt	% Raw Coal Ash	% Raw Coal S	—% Recovered Coal— Wt.	—% Recovered Coal— Ash	—% Recovered Coal— S	% Refuse Wt.	% Refuse Ash	% Ash Reduction
CS_2	150	....								
C_6H_6	150	4	31.4	1.63	61.0	5.9	0.89	39.0	71.6	81.2
CCl_4	150	....	31.4	1.63	63.0	6.5	0.86	37.0	73.9	79.3
Gas oil	80	40	31.4	1.63	62.3	6.5	0.91	37.7	72.2	79.3
Fuel oil	64	135	31.4	1.63	62.3	6.4	0.66	37.7	73.0	79.6
Cylinder oil A	64	400	31.4	1.63	66.7	8.6	0.90	33.3	76.8	72.6
Cylinder oil B*	80	4,000	31.4	1.63	69.0	10.7	0.88	31.0	78.0	66.0
			31.4	1.63	74.6	14.0	1.37	25.4	82.2	55.4

*Water heated to 70° C.

Apparently the efficiency of ash separation begins to diminish when an oil greater in viscosity than about 40 seconds Saybolt is employed. Combustible loss in the refuse is somewhat less with the more viscous oils. Considerably more of the liquids of low viscosity such as benzol and carbon tetrachloride must be used to obtain a coherent amalgam than of the oils of higher viscosity.

Amount of Oil Used

In the greater part of our work, oil has been used in an amount equal to 0.3 lb. per pound of dry cleaned coal. If a coal contains 25 per cent of removable refuse, it will be necessary to use 450 lb. or about sixty-two gallons of a light fuel oil per ton of raw coal treated. With coal ground to pass a 200-mesh screen, this quantity of oil produces an amalgam in granules about one-eighth inch in diameter. If finer ground coal is employed, it may be necessary to use as much as 0.4 lb. oil per pound of dry cleaned coal. It is best to work with as small an amount of oil as possible because better washing of the amalgam is possible when the granules are fairly small, and the resultant cleaned coal contains less ash.

Oil Losses, Emulsification

Although at first sight it might be thought that considerable oil would be lost as a result of emulsification in the water, experiments have shown no appreciable loss due to this cause. Apparently the presence of finely pulverized coal in the water effectively prevents emulsification. As a matter of fact, certain commercial emulsions such as water gas tar and B. S. emulsion are broken down by the addition of pulverized coal and may be used as oils for carrying out the Trent process. Even if a certain amount of oil were retained in the water, the use of this water over again after separation of the refuse, would eliminate loss from this source.

Absorption in the Refuse

The oil retained by the refuse is seldom more than 1 per cent of the total oil used and frequently is practically zero. In certain cases where a large amount of refuse high in carbon and pyrite has been removed, the oil absorbed in this refuse has been as much as 10 or 15 per cent of the total oil used.

Volatilization

Volatilization losses are negligible with the heavier petroleum oils but, of course, quite appreciable in the case of gasoline or benzol. It is hardly likely, however, that such volatile oils will be used in any commercial application of the process.

Our results point to the conclusion that oil losses in the first stage of the process, i. e., agitation and separation of refuse, will be negligible. Recovery of oil from the amalgam by distillation is another matter and one outside the scope of the present article.

Amount of Water Retained in the Amalgam

An amalgam in granules one-eighth inch or larger usually retains 8 to 12 per cent moisture which will not drain out of the mixture, in addition to the hygroscopic moisture of the coal. It has been found possible to reduce this moisture to about 5 per cent by passing through a kneading machine of the meat-chopper type. In an amalgam of very fine granules, the moisture content may be as high as 30 or 40 per cent. A large part of this moisture occurs as a coating of the small particles and is separated by further agitation or the addition of more oil to effect the formation of larger granules. The size of the granules depends upon the amount of oil used, the size of the coal particles, the method of agitation and time of agitation and to some extent on the character of the coal. Certain sub-bituminous coals require more oil to produce granules of a given size than do the bituminous coals or anthracite.

Method of Agitation

Brisk agitation of the kind given by rapidly revolving paddle blades is most efficient in separating mineral matter from coal and in securing rapid formation of the amalgam. At the beginning of our work, oil, coal and water were shaken in a stoppered bottle on a shaking machine. This method of agitation was first employed because it gave conditions of agitation which could be duplicated for a series of tests and permitted of quantitative treatment of materials. It was soon found, however, that better ash reduction was obtained by agitation in a small glass churn with paddle blade revolving at 1,000 r.p.m. and that certain coals which did not form an amalgam when shaken in the bottle were readily worked in

the churn. A comparison of values with churn and shaker for a typical coal follow:

ANTHRACITE CULM 34647

	% Raw Coal		% Recovered Coal — Ash		% Recovered Coal — Sulphur		—% Refuse — Ash Contents		% Ash Reduc.	
	Ash	S	Churn	Shaker	Churn	Shaker	Churn	Shaker	Churn	Shaker
Mesh 65	27.7	1.00	12.8	18.5	0.81	0.81	78.0	75.0	53.8	33.2
Mesh 200	27.7	1.00	9.0	11.8	0.78	0.79	82.0	80.0	67.5	57.4
Mesh 600	27.7	1.00	6.5	10.0	0.66	0.67	87.0	89.0	76.5	63.9

Time Required for Formation of the "Amalgam"

Coals differ very much in the rapidity with which they form the so-called amalgam. As a general rule, it may be stated that coals containing more than 3 or 4 per cent hygroscopic moisture as received will be difficult to work. When they contain 20 or 30 per cent moisture, as do the lignites, separation is practically impossible, even with prolonged agitation.

It has not been found possible to get good separation of carbonaceous material from mineral matter by treatment of the raw lignite. Lignites are very readily wetted by water, and once the lignite is well wetted with water, either by wet grinding or by soaking, the water is not readily displaced by oil. On agitation of a wet ground mixture of lignite with oil, there is some tendency for separation into layers of coal oil and refuse water, but no formation of the compact agglomerate of coal and oil which takes place with bituminous coals or anthracites. Microscopic examination of the mixture shows globules of oil suspended in the mixture of lignite and water, indicating a high surface tension between the oil and the coal-water mixture.

Name of Coal	Time of Agitation — 1st Separation Minutes	Time of Agitation — Completion Minutes	ANALYSIS — H_2O	Vol. Matter	Fixed Carbon	Ash	Sulphur
Pittsburgh	½	10	1.53	33.42	52.72	12.33	1.25
Upper Freeport I	2	30	1.50	34.40	54.92	9.18	2.25
Illinois II	2	30	2.50	31.87	52.42	9.93	1.28
Illinois I	30	180	10.93	36.22	40.30	112.55	4.03
Oklahoma	5	120	5.10	35.80	41.40	17.70	4.46
Indiana	1	30	1.75	42.75	45.80	9.70	4.19
Texas lignite	60	..	26.68	31.97	26.55	14.80	1.41
Texas lignite, carbonized	20	120	0.05	10.95	55.50	33.50	1.44
California lignite	60	..	15.20	48.31	21.29	15.20	1.60
California lignite, carbonized	30	120	0.05	19.05	45.80	35.10	1.77
Anthracite culm I	2	30	2.15	7.27	64.87	27.70	1.00

Inspection of Table I will show that the two samples of lignite were carbonized at 500 deg. Cent. before treatment. Mere drying of the coal at 110 deg. Cent. is not sufficient. The structure of the coal is not changed by such treatment and the water so driven off is reabsorbed when the coal is soaked in water prior to treatment by the Trent process. It is necessary to carbonize the lignite at a sufficiently high temperature to so change its structure that it is no longer hygroscopic. . When this is done and the carbonized material finely pulverized by grinding in the ball mill, the formation of the amalgam takes place readily although a large ash reduction is not obtained with the brown woody lignites. The mineral matter in these lignites is apparently very finely disseminated throughout the coal substances and complete separation is not attained even at the finest degree of pulverization possible by grinding in the ball mill or about five microns (005 mm.).

In considering the efficiency of the Trent process in cleaning a given coal, we must then consider a third factor—time of agitation—in addition to ash reduction and combustible recovery. This factor assumes importance with the sub-bituminous coals and lignites. Obviously, overhead expenses will become greater as the time of agitation increases, and there will be a length of agitation beyond which it will not be profitable to go. In the following table are set down analyses of a number of coals together with the time for which it was found necessary to agitate these coals when treating them by the Trent process. Two figures for time of agitation are given, the first column being the time the mixture was agitated before a separation into small agglomerates of coal and oil were visible. At this time the granules of coal and oil are soft and cannot be separated from the refuse by screening. After a further period of agitation, the granules become larger and more coherent, and may be filtered from the refuse and water by screening. The figures in the second column show the total time taken for agitation and screening of the amalgam and for the several agitations in fresh water for removal of the last traces of refuse.

Fineness of Pulverization

The Trent process is unique among coal-cleaning methods in that it treats coal in a very finely pulverized condition. Any advantages which are obtained by treatment of finely pulverized coal are advantages peculiar to the process. In the course of the investi-

RELATION BETWEEN FINENESS OF GRINDING AND ASH REDUCTION

	Average Size of Particles (microns)	Anthracite Culm I (%)	Anthracite Culm II (%)	Upper Freeport I (%)	Upper Freeport II	Upper Freeport Bone Coal Refuse	Ill. I	Oklahoma	Indiana	Wash. Bitu.	Wash. Sub-bitu.
Ash in raw coal	...	27.7	31.4	9.3	9.5	21.7	16.6	19.5	9.9	22.6	19.3
Ash in recovered coal:											
Mesh 65	130	12.8	13.7	7.9	9.5	17.2	7.6	5.8	9.0	17.1	12.6
Mesh 200	35	8.0	6.0	7.4	9.4	13.1	5.6	5.7	9.0	16.0	11.7
Mesh 600	10	6.0	5.0	6.7	7.5	12.0	7.4	4.3	6.3	13.6	10.0
Ash in refuse:											
Mesh 65	130	78.0	70.0	84.0	...	...	65.1	57.7	...	70.0	62.9
Mesh 200	35	82.0	72.0	84.0	...	80.0	55.7	50.5	...	77.0	70.0
Mesh 600	10	88.0	88.0	87.6	86.0	88.0	69.7	30.0	86.2	85.0	80.0
Sulphur in raw coal	...	1.0	1.6	2.3	0.9	0.9	5.3	4.7	4.4	0.5	0.5
Sulphur in recov. coal:											
Mesh 65	130	0.8	1.6	1.9	0.9	0.9	4.3	3.5	4.1	0.5	0.5
Mesh 200	35	0.8	0.9	2.1	0.8	1.0	3.7	3.1	4.1	0.5	0.5
Mesh 600	10	0.7	0.9	2.3	0.9	0.8	5.3	2.6	4.3	0.5	0.5
Per cent ash reduction:											
Mesh 65	130	53.7	56.4	15.1	...	20.7	54.2	70.3	14.2	24.4	34.7
Mesh 200	35	71.1	81.0	20.4	1.1	39.6	66.2	70.7	9.1	29.2	39.4
Mesh 600	10	78.3	84.1	28.0	21.0	44.6	54.4	77.9	36.4	39.8	48.1

gation, a considerable amount of work has been done to determine the relation between fineness of grinding, ash removal, and combustible recovery, or, in other words, to show to what degree of fineness it is necessary to grind different coals in order to secure optimum separation of mineral matter from combustible matter.

The following table summarizes the results of Trent process treatment of a number of coals at different meshes. A subsequent paper will discuss the subject of fineness of grinding at some length, and will consider methods of determining the average size of coal particles in samples pulverized finer than 300 mesh. It is evident from the data as presented in the table that grinding finer than 200 mesh does not give sufficiently greater ash reduction to pay for the increased cost of the finer pulverization. The percentage of combustible matter in the refuse decreases with finer pulverization but it may not be sufficient to warrant the added expense of grinding from 200 mesh to 600 mesh or finer. Sulphur reduction is in general at a maximum with the 200-mesh material.

Fusibility of Ash

A number of comparative determinations of the fusibility of ash in raw and cleaned coal were made. Where any considerable amount of ash has been removed, the ash from the cleaned coal shows either a slightly higher softening temperature or larger softening interval. This was not true in the case of the bituminous coal from Oklahoma. Results are given in the following table.

Summary

This paper has presented the results of laboratory-scale tests of the efficiency of the Trent process in cleaning coal. A noteworthy feature of the operation

FUSION TEMPERATURE OF ASH IN RAW AND CLEANED COAL

Coal	Lab. No.	Raw or Cleaned	—Fushion Temp. of Ash— Sftng. Temp. (°F.)	Sftng. Interval (°F.)	Flowing Interval (°F.)	—Analysis— Volatile Matter (%)	Fixed Carbon (%)	Ash (%)	Sulphur (%)
Anthracite Culm I	34647	Raw	2280	220	50	7.43	64.87	27.70	1.00
Anthracite Culm I	79024	Cleaned	2620	360	70	19.10	73.20	7.70	0.72
Anthracite Culm II	76975	Raw	2390	110	100	7.83	60.81	31.36	1.63
Anthracite Culm II	77556	Cleaned	2680	50	50	12.40	78.72	8.88	0.98
Bituminous, Upper Freeport II	34643	Raw	2510	130	230	34.50	56.03	9.47	0.85
Bituminous, Upper Freeport II	77348	Cleaned	2510	390	120	32.21	60.25	7.54	0.85
Bituminous, bone coal refuse	34645	Raw	2510	230	120	30.12	48.14	21.74	0.93
Bituminous, bone coal refuse	77349	Cleaned	2740	460	140	32.92	54.84	12.24	0.80
Bituminous, Pittsburgh	34867	Raw	2340	140	110	34.14	53.29	12.57	2.34
Bituminous, Pittsburgh	76418	Cleaned	2340	300	50	34.81	59.00	6.19	1.69
Bituminous, Pittsburgh	78385	Raw	2310	30	170	33.94	53.54	12.52	1.27
Bituminous, Pittsburgh	78519	Cleaned	2280	200	210	34.29	59.85	5.86	1.19
Bituminous, Indiana	76027	Raw	2110	130	140	43.51	46.62	9.87	4.26
Bituminous, Indiana	78282	Cleaned	2280	340	40	44.30	49.41	6.29	4.27
Bituminous, Oklahoma	75631	Raw	2040	200	120	37.72	43.63	18.65	4.70
Bituminous, Oklahoma	77049	Cleaned	2060	80	270	32.47	33.76	8.77	3.83
Bituminous, Washington	76185	Raw	2510	120	70	30.54	42.55	26.91	0.61
Bituminous, Washington	77686	Cleaned	+2730	+90	...	36.71	50.82	12.47	0.99
Sub-bituminous, Washington	75897	Raw	+2680	...	...	39.13	41.53	19.34	0.48
Sub-bituminous, Washington	77823	Cleaned	+2730	+90	...	43.33	42.99	13.68	0.59

of the process is the cleanness of separation of mineral matter from combustible matter. Combustible recovery has averaged better than 95 per cent. High ash reduction has been obtained with the bituminous coals and anthracites. Sulphur reduction has been good in the case of anthracites but poor with the bituminous coals. It has not been found feasible to treat the lignites without preliminary carbonization, due to the difficulty of forming a coherent agglomerate of the raw lignite and oil. Finer pulverization than 200 mesh does not give a sufficient increase in ash reduction with most coals to warrant the added expense of the longer period of grinding. Any oil whose viscosity is not too great may be employed in the process. Oil losses in the refuse or water are apparently negligible.—U. S. Bureau of Mines, Reports of Investigations.

Charles Otis Bond

C. O. Bond died at his home in Collegeville, Pa., on Tuesday, August 2. He had been ill for several months and had undergone an operation which failed to save his life.

Mr. Bond was one of the leading illuminating experts of this country. He had served a term as president of the Illuminating Engineering Society, and was a member of the American Gas Association and of the Meridan Club. He specialized on research and experimental work tending to improve gas lighting equipment and methods. His most important achievement in this line was the standardizing of apparatus for improving the economic efficiency of gas burners and mantles. This work he engaged in as director of the physical laboratory of the United Gas Improvement Company, and it brought him a world-wide reputation.

He was the inventor of the "dewpoint" hygrometer for determining the lowest temperature which gas reached in the mains. This device has proven to be of great value to gas companies in maintaining uniform gas service, especially in climates subject to sudden changes of temperature.

Mr. Bond was born in Iowa fifty years ago. He was graduated from the United States Naval Academy in 1886. During the Spanish-American War he served as a lieutenant in the United States Navy. In 1896 he became connected with the Philadelphia Gas Works, leased by the United Gas Improvement Company, and remained in the employ of that company until the time of his death.

He contributed many valuable papers to the technical and trade journals and was always a forceful and interesting speaker at important meetings of the gas fraternity.

Mr. Bond is survived by a widow and two children. His son, Charles, is now a student in the United States Naval Academy. A daughter, Mrs. Harvey Preston, is in Siam, where with her husband she is doing missionary work. Her field of operations is beyond the lines of ordinary communication so that it will be many weeks before she learns of her father's death.

Mr. Bond's funeral took place on Friday, August 5, from the Forrest Presbyterian Church, Germantown, Philadelphia. It was attended by many of his fellow workers from the United States Gas Improvement Company.

TABLE II—SUMMARY OF TRENT PROCESS RESULTS

Kind of Coal	Lab. No.	Amt. Oil Used, Gal. per Ton	P. C. Raw Coal—Ash	P. C. Raw Coal—Corrected Ash	P. C. Raw Coal—Sulphur	P. C. Cleaned Coal—Weight	P. C. Cleaned Coal—Ash	P. C. Cleaned Coal—Sulphur	P. C. Refuse—Weight	P. C. Refuse—Ash	P. C. Refuse—Corrected Ash	P. C. Refuse—Sulphur	P. C. Efficiency—Ash Reduction	P. C. Efficiency—Com. Recovery	P. C. Efficiency—Sul. Reduction	Time of Agitation Hours
Anthracite Culm I	34647	65	27.7	30.4	1.00	74.0	7.0	0.70	26.0	87.0	95.0	1.99	74.7	97.8	30	0.5
Anthracite Culm II	76975	65	31.4	34.8	1.63	69.0	6.5	0.85	31.0	87.0	95.6	3.05	79.2	98.0	48	0.5
Anthracite, Rhode Island	78127	75	21.7	23.8	0.85	82.0	6.7	0.83	18.0	90.7	98.3	0.95	69.2	99.5	..	2.0
Bituminous, Pittsburgh	34768	80	12.5	14.2	1.27	92.0	6.0	1.34	8.0	88.0	95.2	0.40	52.0	99.5	..	0.1
Bituminous, Upper Freeport	76974	80	9.3	11.2	2.28	96.5	6.7	2.34	3.5	87.6	94.8	0.60	28.0	99.7	..	2.0
Bituminous, bone coal refuse	34645	80	21.7	23.9	0.93	88.0	12.5	0.80	12.0	88.7	96.9	2.08	42.3	99.4	14	1.0
Bituminous, Illinois	25637	80	16.6	20.7	5.33	85.0	7.4	5.28	35.0	69.7	76.6	2.25	55.4	89.8	1	3.0
Bituminous, Indiana	76927	80	9.9	13.0	4.38	96.4	6.3	4.27	3.6	86.2	93.5	0.80	36.4	99.8	3	0.5
Bituminous, Oklahoma	25631	80	19.5	23.6	4.74	69.0	5.7	3.08	31.0	50.5	59.0	8.50	70.8	83.5	35	2.0
Bituminous, Washington	76142	80	22.6	24.7	0.49	87.5	13.6	0.50	12.5	85.0	92.1	0.50	39.8	98.7	..	0.5
Bituminous, refuse, New Mexico	77989	60	54.7	59.3	0.55	45.0	22.9	0.86	55.0	80.6	87.3	0.29	58.1	82.8	..	2.0
Bituminous, refuse, Tennessee	77541	50	63.5	69.4	1.64	31.0	20.6	1.48	69.0	82.7	90.2	1.65	67.7	77.8	10	2.0
Bituminous, refuse, Alabama	77864	80	23.5	26.2	1.60	80.5	6.6	1.76	19.5	92.8	100.7	0.90	72.0	100.0	..	1.0
Sub-bituminous, Washington	75897	80	19.3	21.1	0.48	87.0	10.0	0.50	13.0	80.0	86.7	0.45	48.4	97.8	..	3.0
Lignite, California*	76026	80	35.1	39.3	1.77	81.5	25.7	1.56	18.5	75.9	83.2	2.30	26.8	95.0	12	2.0
Lignite, Texas*	75823	80	33.5	36.9	1.44	79.7	18.1	1.42	20.3	94.2	102.4	1.25	46.0	100.0	1	2.0
Bituminous, Brazil	78226	60	35.6	39.7	2.47	66.0	9.4	2.32	34.0	86.0	94.4	2.71	73.6	97.0	6	4.0

*Carbonized at 500 deg. Cent.

Public Utilities Securities Market Report

Prices of Representative Gas Bonds

(Quotations furnished by The National City Company)

Company	Issue	Maturity	Aug. 11, 1921 Bid	Asked
American Lt. & Trac. Co.	Five Year 6s	May 1, 1925	91	92½
Brooklyn Union Gas Co.	First Consol. 5s	May 1, 1945	81	83
Columbia Gas & Elec. Co.	First 5s	Jan. 1, 1927	84	87
Consol. Gas, Elec. Lt. & Pr. Co. of Baltimore	First Ref. 7½s	Dec. 1, 1945	98⅞	99⅝
Consol. Gas, Elec. Lt. & Pr. Co.	General 4½s	Feb. 14, 1935	76	78
Consol. Gas Co. of New York	Sec. Conv. 7s	Feb. 1, 1925	101½	101¾
Consol. Gas Co. of New York	One Year Sec. 8s	Dec. 1, 1921	100	100¼
New Amsterdam Gas Co.	First Consol. 5s	Jan. 1, 1948	64½	66
Denver Gas & Elec. Co.	Gen. (now 1st) 5s	May 1, 1949	79	82
Detroit City Gas Co.	Gold 5s	Jan. 1, 1923	90	92
Equitable Illum. Gas Lt. Co. of Philadelphia	First 5s	Jan. 1, 1928	96	98
Hudson County Gas Co.	First 5s	Nov. 1, 1949	72	74
Laclede Gas Light Co.	Ref. & Ext. 5s	Apr. 1, 1934	75½	77
Louisville Gas & Elec. Co.	First & Ref. 7s	June 1, 1923	95	96½
Michigan Light Co.	First & Ref. 5s	Mar. 1, 1946	69	72
Milwaukee Gas Light Co.	First 4s	May 1, 1927	81	83
Pacific Gas & Elec. Co.	Gen. & Ref. 5s	Jan. 1, 1942	78	78½
Pacific Gas & Elec. Co.	Col. Tr. Conv. 7s	May 1, 1925	97	98
Pacific Gas & Elec. Co.	First & Ref. 7s	Dec. 1, 1940	99¼	100
Cal. Gas & Elec. Corp.	Unif. & Ref. 5s	Nov. 1, 1937	84	86
Peoples' Gas Lt. & Coke Co.	Refunding 5s	Sept. 1, 1947	74½	76
Chicago Gas Lt. & Coke Co.	First 5s	July 1, 1937	78¾	80
Portland Gas & Coke Co.	First & Ref. 5s	Jan. 1, 1940	77	79
Seattle Lighting Co.	Refunding 5s	Oct. 1, 1949	67	70
Southern California Gas Co.	First 6s	Nov. 1, 1950	83½	86
United Gas Improvement Co.	Two Year 8s	Feb. 1, 1923	99⅜	99⅝
Utica Gas & Electric Co.	Ref. & Ext. 5s	July 1, 1957	79	81
Washington Gas Light Co.	General 5s	Nov. 1, 1960	76	77
Western States Gas & Elec. Co. of California	First & Ref. 5s	June 1, 1941	77	80

Orders Better Gas Supply

Trenton, N. J.—Following complaints against the alleged poor quality of gas supplied by the Wildwood Gas Company, which was recently permitted to increase rates from $2.10 to $2.50 per thousand cubic feet, Secretary Barber of the State Public Utility Board warned the company not to put the new rate into effect until it had made certain repairs to its equipment to improve the quality of the gas.

The new rate was allowed contingent upon those repairs. The company has been informed that if a higher rate has been collected before the completion of these repairs the difference between the old and the new rate must be refunded to consumers.

Appointed Trustee

The New York Trust Company has been appointede trustee under indenture of the Cincinnati Gas & Electric Company dated Aug. 1, 1921, given to secure an issue of $6,000,000 par value convertible 8 per cent secured gold notes due Dec. 1, 1922.

Elect Officers

St. Johnsbury, Vt.—At the annual meeting of the stockholders of the St. Johnsbury Gas Company these officers were elected: President, F. M. Abbott; vice-president, H. J. Goodrich; secretary and treasurer, M. K. Rann. Directors, F. M. Abbott, H. J. Goodrich, E. G. Asselin, L. P. Leach, C. B. Weeks.

These are the same officers as last year an dthe only change on the directorate is the election of C. B. Weeks to succeed his father, the late Charles Weeks.

To Lay Forty Miles of Gas Pipe

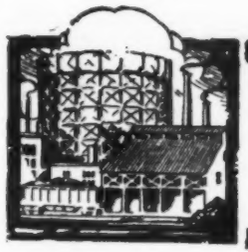
Olean, N. Y.—Better service for patrons of the Producers Gas Company of this city is planned. The company serves the tenth and eleventh wards of Olean, formerly the villages of Boardmanville and East Olean, and a number of towns in this section. It will lay forty miles of pipe in the gas country around Bolivar and Shinglehouse, and work will be started to-morrow. The contractors have already shipped part of the camping outfit to the first camp location. The job will give employment to 100 men and 20 teams.

Service Rates Cut

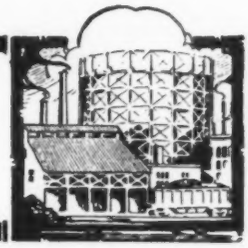
Carlisle, Pa.—Beginning August 1, the Carlisle Gas & Water Company has announced a reduction of 5 per cent per thousand cubic feet of gas and 1 mill on the electricity rate. This cut was made in accordance with a promise made the consumers last December, it was announced by George M. Hays, the general manager.

Changes in Staff

S. G. Fraser, for the past six years connected with the Oakland office of the Pacific Gas & Electric Company, has been appointed manager of the Antioch office, succeeding C. P. Sanford, transferred from there to the managership in Marysville.



NEWS OF THE GAS INDUSTRY



Brooklyn Union Gas Rate Cut 25 Cents

Brooklyn, N. Y.—The gas rate charged consumers by the Brooklyn Union Gas Company was reduced 25 cents August 1, from $1.50 a thousand cubic feet to $1.25. August bills, delivered in September, will be based on the reduction.

The new rate is the result of a voluntary offer by James H. Jourdan, president of the company, and Col. William N. Dykman, counsel, who told Chairman William A. Prendergast, of the State Public Service Commission, two months ago, that as soon as the then present supply of costly material gave out they would reduce their rates.

Cincinnati to Improve Plant

Columbus, Ohio.—The State Public Utilities Commission has authorized the Cincinnati Gas & Electric Company to issue $7,500,000 prior lien and refunding mortgage forty year, 7 per cent gold bonds to be pledged as surety for $6,000,000 convertible 8 per cent gold notes, dated Aug. 1, 1921, and maturing Dec. 1, 1922. The notes are to be sold at not less than 95 or par.

Of the proceeds of the note issue, $3,183,050.02 are to reimburse the company for capita lexpenditures to June 1, 1921, and the remaining $2,509,749.48 are to be used for additions and betterments to the plant.

New Process for Making Gas from Old Oak Logs

London, England.—Gas made from old oak logs is now being supplied successfully to the inhabitants of Steyning in Sussex. Other towns are rapidly following suit. It is claimed that this wood gas has practically the same heating and lighting properties as coal gas and its use means a saving of more than half a dollar per thousand cubic feet to the consumer.

The Steyning gas works being threatened with closure owing to the prohibitive price of coal, about five pounds a ton, the carbonization of wood was resorted to as an experiment with the result that wood gas has been definitely adopted as an illuminant until the price of coal comes down.

At Birmingham, old road paving blocks have been converted into wood gas with equally satisfactory results.

Court Halts Tax Collection

Cairo, Ill.—Injunctions restraining the sheriff of Alexander County from collecting taxes assessed by the Illinois Tax Commission on capital stock of the Cairo Electric and Traction Company, the Cairo City Gas Company and the Hallidey Elevator Company were issued in circuit court here. The corporations declared that collection of the tax would subject them to double taxation. The cases are regarded as tests, and are expected to have an effect over the entire State.

Dividends

The Fall River Gas Works Company has declared a quarterly dividend of $3 a share, payable August 1. This is the usual rate.

Contract Awarded

The Gas Machinery Company, of Cleveland, Ohio, has been awarded contract for a new fifteen-foot diameter by twelve-foot high duplex steel purifier complete with trays and tray beams, dry seal cover and doors, cover hoist, gas valves and connections, by the Leominster Gas Light Company of Leominster, Mass.

This purifier and connections are to be used in connection with the two purifiers of the same make which the gas company is now using and will enable the gas company to continue the good service they have given in the past with the increase in send-out.

The Leominster Gas Light Company recently installed a new water gas apparatus built by the same contractors and the gas plant is now all in first-class condition and ready to take care of the increased load.

Seaboard, N. J.—An additional gas holder is being erected here for the Seaboard By-Products Coke Company. The work on this new holder is being done by the Western Gas Construction Company of Fort Wayne, Ind.

Tells How to Save Gas

Milwaukee, Wis.—Much gas is wasted if the burners on gas stoves are more than one and one-quarter inches below the cooking utensils, says the Wisconsin Gas Association. This waste can be stopped by having burners raised. Burners should be cleaned often. Solid type cook stoves are wasteful and inefficient. Grid tops or skeleton lids only should be used. Gas burners used in coal furnaces or stoves waste 75 per cent of the gas. Ordinary water tank heaters with burners under neath are large wasters of gas. All such tanks should be inclosed in a jacket of galvanized tin sovered with asbestos paper with openings at the top.

Widow Sells Home

Mrs. Annie K. Lamson, widow of Charles D. Lamson, former president of the Worcester Gas Light Company, has sold her residence at 49 West Street, Worcester, Mass., to P. Howard Blanding of Providence, R. I., who is associated with the Daniels-Cornell Company of Worcester. The property consists of an eleven-room dwelling, about 5,000 sq. ft. of land, and is assessed for $8,200.

Public Service Commission Closes Session

The Public Service Commission at Harrisburg announced that an executive session was to be held Monday, July 25, to dispose of pending cases, the next session to be held in August.

Securities Sold to Consumers

Santa Barbara, Cal.—Following the example of other corporations which have successfully appealed to the public direct for the disposal of securities, the Southern Counties Gas Company, of Los Angeles, which serves Santa Barbara and adjacent territory, launched its campaign along these lines here recently. At a dinner at the Patio to about 100 persons, including the employees of the company and members of their families from Ventura and Santa Barbara Counties, announcement was made that an opportunity would be given to secure the stock direct.

Heretofore it has been handled through a firm of Chicago brokers, who profited to the extent of $20,000 to $25,000, and this sum is diverted this time for the benefit of employees.

In making its announcement the company distributed folders setting forth reasons for investors taking hold of its securities. It addresses the folder "To our consumers," and says:

The continued growth and prosperity of any community is largely dependent upon the success and development of the various public utilities serving that community. It is of utmost importance to unite as closely as possible the interests of the public utility and the consumers served by it. Several of the larger public utilities of California have recently adopted the policy of encouraging their consumers and the people in the territory served to become partners in the public utility business, thus affording the consumers a sound and profitable investment, and at the same time obtaining their active co-operation in the building up of the community.

Believing in the wisdom and soundness of this policy, the Southern Counties Gas Company of California has decided to issue and offer to its consumers and the people in the territory served by it $1,250,000 par value, of its 8 per cent cumulative preferred stock, this being the only preferred stock issued by the company. The 8 per cent cumulative preferred stock of the company is an unusually attractive investment. The stock is preferred over the common stock, both as to assets and as to dividends. The stock is sold at a price of $99 per share when purchased outright, or at $100 per share on easy installment plans of $10 per month to those who prefer to pay by installments. Interest at the rate of 8 per cent per annum, payable quarterly, is paid upon all installment payments. This should appeal very strongly to the small investor, as he is thereby assured of an 8 per cent return immediately upon his investment.

As commodity prices fall, rates of interest paid by securities generally will tend to decline to their former pre-war level. Under our articles of incorporation our preferred stock must bear 8 per cent upon its par value.

The Southern Counties Gas Company is now supplying an unsurpassed quality of gas to forty-three cities and towns in southern California, as well as the interurban territory surrounding these cities and towns. The district supplied by this company is undoubtedly the most productive, from an agricultural standpoint, as well as the most rapidly growing portion, of the State of California.

The consumers of the company now number in excess of 77,000, and the business of the company is growing rapidly year by year.

In summing up the special advantages of such an investment it says that they are:

An immediate and direct return of 8 per cent per annum is received by the investor in this stock.

Interest at 8 per cent per annum, payable quarterly, upon all installment payments upon purchase price, giving the investor an 8 per cent return upon his money from the very beginning.

This issue of $1,250,000 preferred stock is the only preferred stock issued by the company.

Free from all State, county and municipal taxes in California except inheritance taxes.

Exempt from normal Federal individual income tax.

Dividends paid directly to you four times a year—January 15, April 15, July 15 and October 15.

Investment may be made in any amount from one share upward.

Payments can be made in ten equal installments if desired.

The development of the community served by the company will be aided by your investment in this stock.

Information regarding the company is available at all times to stockholders.

Officers of the company and others were present and spoke briefly on the plan, the principal address, comprehensively outlining the company's policy, being by LeRoy M. Edwards of Los Angeles, attorney for the corporation. The others were F. H. Bivens, superintendent of the Santa Barbara-Ventura district, who presided at the meeting; Ferdinand R. Bain, of Los Angeles, president and general manager; W. S. McFarland, of Los Angeles, secretary; T. H. Dudley, of Los Angeles, treasurer; F. S. Wade, of Los Angeles, superintendent of operation; J. D. Lowsley, cashier, First National Bank, Santa Barbara; Judge Robert M. Cark, of Los Angeles, former judge of the superior court, Ventura; Carl Summers, assistant district superintendent, Ventura; A. W. Stone, of Los Angeles, of the corporation's stock department; and Clyde H. Potter, of Los Angeles ad vertising and publicity.

Superintendent Bivens called a meeting to organize his district for the stock-selling campaign to employees and the public. He will compete against other districts for the best showing.

Chancery Aid to Sell Gas Property

Trenton, N. J.—Application will be made to the chancery court shortly by counsel for the receiver of the Standard Gas Company for permission to sell the property of the company free and clear of all encumbrances. The gas company supplies about twenty municipalities in Monmouth County. Joseph F. Stricker, of Perth Amboy, is the receiver.

The Girard Trust Company, of Philadelphia, trustee for the bondholders of the company, instituted the chancery proceedings for the foreclosure of a mortgage of $619,000, given to secure the bonds. There is a dispute over the mortgaged property, Receiver Stricker having made certain improvements and additions which he claims the mortgage in question does not cover.

Gas Company Enters Merger

Du Quoin, Ill.—The Du Quoin Light, Heat & Power Company, of this city, has merged its interests with those of the Murphysboro Water Works & Electric & Gas Light Company and the Southern Illinois Gas Company, and will be known hereafter as the Southern Illinois Gas Company.

The company is now under the management of W. C. Paul, who is an experienced man in the gas-making business and one who has shown his ability to the Du Quoin people by rendering them the best possible service.